WHAT IS CLAIMED IS:

1. An optical encoder comprising:

a light source unit;

a scale which has a periodic optical pattern and displaces relatively to the light source unit; and

a light detector to detect a light beam emitted from a light source of the light source unit and traveled by way of the scale;

wherein the light source unit has a light beam exit opening through which a light beam is emitted toward the scale, and

assuming that a distance between the light beam exit opening and the scale is z1, a distance between the scale and the light detector is z2, and a pitch of the periodic optical pattern of the scale is p1, the width W of the light beam exit opening in a scale moving direction is determined depending on the values of z1, z2, and p1.

2. The optical encoder according to claim 1, wherein the width W of the light beam exit opening in the scale moving direction is specified as follows:

$$p1 \times (2n - 1.5) \times (z1 + z2)/(2 \times z2) \leq W \leq p1 \times (2n - 0.5) \times (z1 + z2)/(2 \times z2)$$

where n is a natural number.

3. The optical encoder according to claim 2, wherein the width W of the light beam exit opening in the scale moving direction is approximately represented

as follows:

$$p1 \times (2n-1) \times (z1 + z2)/(2 \times z2).$$

4. The optical encoder according to claim 2, wherein the values of z1 and z2 are substantially equal to each other.

5. The optical encoder according to claim 2, wherein one or more light beam exit openings are disposed in the scale moving direction at a position of $(z1 + z2)/z2 \times m$ (where m is a natural number) times of the pitch p1 of the periodic optical pattern of the scale.

6. The optical encoder according to claim 5, wherein the light beam exit opening of the light source unit is a light beam exit window formed on a light beam emission surface of the light source, and the width W of the light beam exit opening in the scale moving direction is the width WLs of the light beam exit window in the scale moving direction.

7. The optical encoder according to claim 5, wherein the light beam exit opening of the light source unit is an optical element disposed on an optical path of a light beam from the light source toward the scale and transmitting a predetermined portion of the light beam.

8. The optical encoder according to claim 7, wherein the light beam exit opening of the light source unit, the scale, and the light detector are arranged in

a predetermined relation capable of detecting a Talbot image.

9. The optical encoder according to claim 7, wherein the optical encoder is configured to satisfy approximately the relation of $1/z1 + 1/z2 = \lambda/(n(p1)^2)$, where λ is a wavelength of the light beam emitted from the light beam exit opening; and n is a natural number.

10. The optical encoder according to claim 7, wherein the optical element transmitting the predetermined portion of the light beam is a slit having a light transmitting portion and a light shielding portion, and the width W of the light beam exit opening in the scale moving direction is the width Ws of the slit in the scale moving direction.

11. The optical encoder according to claim 10, wherein the slit has a plurality of openings in the scale moving direction, and said plurality of openings are disposed at positions of about integer times of the pitch p2 of the light detector.

12. The optical encoder according to claim 7, wherein the optical element transmitting the predetermined portion of the light beam is a slit having a circular opening, and the width W of the light beam exit opening in the scale moving direction is a diameter Ws of the circular opening.

13. The optical encoder according to claim 12,

wherein the circular opening is plural, and the plurality of circular openings are disposed at a position of about integer times of the pitch p2 of the light detector in the scale moving direction.

14. The optical encoder according to claim 13, wherein the circular opening is plural, and the plurality of circular openings are disposed, in a plane parallel to a pattern surface of the scale, in a direction orthogonal to the scale moving direction.

15. The optical encoder according to claim 10, wherein the light source unit further has a lens which sets a beam divergent angle of the light beam to a predetermined value.

16. The optical encoder according to claim 10, wherein the optical element transmitting the predetermined portion of the light beam is disposed such that the light beam emitted from the light source unit is reflected by the scale, and then does not shield an optical path from the scale toward a region of the light detector having an effective reception sensitivity.

17. The optical encoder according to claim 10, further comprising a plurality of photo detectors which detect a predetermined phase portion of a light intensity pattern on a receiving surface of the light detector formed when the light beam emitted from the light source unit and passing through the scale

impinges upon the receiving surface.

18. The optical encoder according to claim 10, the photo detector of the light detector is configured to be capable of detecting a predetermined phase portion of a light intensity pattern having a pitch of about $p1 \times (z1 + z2)/z1$.

19. The optical encoder according to claim 1, wherein the width W of the light beam exit opening in the scale moving direction is $p1 \times (z1 + z2)/(2 \times z2)$ or less.

20. The optical encoder according to claim 19, wherein one or more light beam exit openings are disposed in the scale moving direction at positions of $(z1 + z2)/z2 \times m$ (where m is an integer of 1 or more) times of the pitch p1 of the periodic optical pattern of the scale.

21. The optical encoder according to claim 20, wherein the light beam exit opening of the light source unit is a light beam exit window formed on a light beam emission surface of the light source, and the width W of the light beam exit opening in the scale moving direction is the width WLs of the light beam exit window in the scale moving direction.

22. The optical encoder according to claim 20, wherein the light beam exit opening of the light source unit is an optical element disposed on an optical path of a light beam from the light source toward the scale

and passing through a predetermined portion of the light beam.

23. The optical encoder according to claim 22, wherein the light beam exit opening of the light source unit, the scale, and the light detector are arranged in a predetermined relation capable of detecting a Talbot image.

24. The optical encoder according to claim 22, wherein the optical encoder is configured to satisfy approximately the relation of $1/z1 + 1/z2 = \lambda/(n(p1)^2)$, where λ is a wavelength of the light beam emitted from the light beam exit opening and n is a natural number.

25. The optical encoder according to claim 22, wherein the optical element transmitting the predetermined portion of the light beam is a slit having a light transmitting portion and a light shielding portion, and the width W of the light beam exit opening in the scale moving direction is the width Ws of the slit in the scale moving direction.

26. A method of adjusting an output signal level depending on a period p2 of a light intensity pattern formed on a receiving surface of a light detector, in an optical encoder comprising: a light source unit; an optical element of the light source unit, which causes a predetermined portion of a light beam emitted from a light source to pass therethrough; a scale which has

a periodic optical pattern and displaces relatively to the light source unit; and a light detector to detect a light beam emitted from the light source unit and traveled by way of the scale, the method comprising:

(i) a step of detecting a light intensity pattern formed on the receiving surface of the light detector;

(ii) a step of checking a level of the output signal depending on the period p2 of the light intensity pattern detected by the light detector;

(iii) a step of determining whether or not the level of the output signal is included in a predetermined range; and

(iv) a step of, when the level of the output signal is not included in the predetermined range of the signal level, changing a distance from the optical element to the scale,

wherein the steps from (i) to (iv) are repeated to adjust the output signal level.

27. An optical encoder comprising:

a light source unit;

a scale which has a periodic optical pattern and dislocates relatively to the light source unit; and

a light detector to detect a light beam emitted from the light source unit and traveled by way of the scale,

wherein the light source unit has an optical unit

which sets a beam divergent angle of the light beam to a predetermined value.

28. The optical encoder according to claim 27, wherein the light source unit, the scale, and the light detector are arranged in a predetermined relation capable of detecting a Talbot image.

29. The optical encoder according to claim 27, wherein the optical encoder is configured to satisfy approximately the relation of $1/z1 + 1/z2 = \lambda/(n(p1)^2)$, where z1 is a distance between the light source unit and the scale, z2 is a distance between the scale and the light detector, p1 is a pitch of the periodic optical pattern of the scale, λ is a wavelength of the light beam emitted from the light source unit, and n is an integer.

30. The optical encoder according to claim 27, wherein the optical element which sets a beam divergent angle of the light beam to a predetermined value is a lens.

31. The optical encoder according to claim 30, wherein the lens is a concave lens.

32. The optical encoder according to claim 30, wherein the lens is an optical system composed of a lens group.

33. The optical encoder according to claim 30, wherein the lens is a cylindrical lens having a focusing action only in the scale moving direction.

34. The optical encoder according to claim 30, wherein the lens has a function of expanding the beam divergent angle of the light beam lens in the scale moving direction, and has a function of focusing the beam divergent angle of the light beam in a plane orthogonal to the scale moving direction and parallel to the scale pattern,.

35. The optical encoder according to claim 30, wherein the optical element which sets a beam divergent angle of the light beam to a predetermined value is disposed such that the light beam emitted from the light source unit is reflected by the scale, and then does not shield an optical path from the scale toward a region of the light detector having an effective optical sensitivity.

36. The optical encoder according to claim 30, further comprising a plurality of photo detectors which detect a predetermined phase portion of the light intensity pattern on a receiving surface of the light detector formed when the light beam emitted from the light source unit and traveled by way of the scale impinges upon the receiving surface.

37. The optical encoder according to claim 30, the photo detector of the light detector is configured to be capable of detecting a predetermined phase portion of a light intensity pattern formed on the receiving surface of the light detector of which period p2 is

about (z2 + z3)/z3 × p1, where z2 is a distance between the scale and the light detector, p1 is a pitch of the periodic optical pattern of the scale, and z3 is a distance from a position of a virtual spot light source to the scale, the position being calculated from the divergent angle of the light beam having passes through the optical element which sets a beam divergent angle of the light beam to a predetermined value.

38. A method of adjusting a level of an output signal depending on a period p2 of a light intensity pattern formed on a receiving surface of a light detector, in an optical encoder comprising: a light source unit; a scale which has a periodic optical pattern and displaces relatively to the light source unit; and a light detector to detect a light beam emitted from the light source unit and traveled by way of the scale, the method comprising:

(i) a step of setting a beam divergent angle of a light beam emitted from a light source of the light source unit to a predetermined value;

(ii) a step of calculating a position of a virtual spot light source from the set beam divergent angle;

(iii) a step of detecting a light intensity pattern formed on the surface of the light detector;

(iv) a step of checking the level of the output signal depending on the period p2 of the light intensity pattern detected by the light detector;

(v) a step of determining whether or not the level of the output signal is included in a predetermined range; and

(vi) a step of terminating the adjustment when the level of the output signal is included in the predetermined range of the output signal, and changing the distance from the calculated position of the virtual spot light source to the scale when the level of the output signal is not included in the predetermined range of the signal level,

wherein the steps from (iii) to (vi) are repeated to adjust the output signal level.

39. An optical encoder comprising:

a light source unit;

a scale which has a periodic optical pattern and dislocates relatively to the light source unit; and

a light detector to detect a light beam emitted from a light source of the light source unit and traveled by way of the scale;

wherein the light source unit has a light beam exit opening through which a light beam is emitted toward the scale, and

the width W of the light beam exit opening in the scale moving direction is determined depending on the value of $p1 \times (z1 + z2)/z2$, where z1 is a distance between the light beam exit opening and the scale, z2 is a distance between the scale and the light detector,

and p1 is a pitch of the periodic optical pattern of the scale.